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In cooperation with the Bureau of Plant Industry, W. A. Taylor, Chief.
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USES FOR CHESTNUT TIMBER KILLED BY THE BARK DISEASE.

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THE CHESTNUT BARK DISEASE.

Most of the chestnut timber north of the Potomac River has been attacked and much of it killed by the bark disease, which is now spreading to Virginia and West Virginia. To prevent the further spread of the disease the Department of Agriculture recommends the destruction of advance infections.[1] The wood of diseased trees may safely be used for any purpose. The problem of utilizing timber cut to destroy advance infections, however, is simple as compared with using the large amount of dead standing timber where the chestnut has been diseased for several years. To help the owner of diseased trees to solve this larger problem is the purpose of this bulletin.[2]

When the spores of the fungus which causes the disease are carried by the wind or other agency into any wound on the trunk or limb of a chestnut tree, they germinate and cause a spreading canker which girdles the part attacked and eventually kills the tree. The disease does not injure the wood; rotten wood is caused by sap rots, heart rots, and insects. Samples of wood from diseased trees examined under the microscope in the Forest Service showed no abnormal structure which could be attributed directly to the bark disease, except that the annual rings of growth developed after the trees became infected were narrower than those formed before infection, the result of the partial girdling of the tree each year by the fungus. Fungous growth was found to penetrate from two to four of the outer

[1] The Bureau of Plant Industry recommends that advance infections be destroyed by felling the trees and burning the bark and brush over the stump, so that the surface of the latter is completely charred, or what is much better, creosoting the surface of the stump and burning the bark and brush in piles.

[2] For detailed information as to the disease and methods of control, see Department of Agriculture Yearbook Separate 598.

NOTE.—This bulletin contains important information as to the utilization that may be made of chestnut timber killed by the bark disease and should be especially valuable to woodlot owners throughout the region affected.

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rings of trees which had been infected for some time, but to cause no injury that lessens the value of the wood. Discoloration of the wood next to the bark is probably due to the breaking down of food material by the fungus in a few cells of the outer sapwood.

STRENGTH AND DURABILITY OF DISEASE-KILLED TIMBER.

Preliminary strength tests conducted by the Forest Service upon chestnut killed by the bark disease indicated that sound wood from dead trees is fully as strong as wood from healthy trees. Disease-killed chestnut seasoned on the stump is probably more durable than green-cut chestnut used unseasoned, owing to the former's comparative dryness. In 1910 a railroad in Pennsylvania rejected a shipment of chestnut ties from Long Island because they were cut from diseased trees. The ties were left piled on the right of way for three years, but upon reinspection in 1913 were found to be so sound that they were finally accepted.

DETERIORATION.

The foregoing statements regarding the strength of timber from disease-killed chestnut trees refer only to sound trees which had not been injured by insects, decay, or checking. In the spring of 1913 the Forest Service carried on a careful investigation of the deterioration of chestnut killed by the bark disease. The number of years since the death of the tree was determined by the age of the oldest sprout at the root collar, since in most cases sprouts do not appear on the root collar before the tree dies. The study considered only the merchantable part of the tree.

Dr. Hopkins, in charge Forest Insect Investigations in the Bureau of Entomology, states that "there is great variation in the amount of insect damage to the wood of chestnut trees killed by the bark disease, but as a rule it is not serious. The greatest damage to the wood by insects is generally caused by the chestnut timber worm before the trees are attacked or killed by the disease, but this insect may continue its work for many years after the trees die." [1]

Sap rot is not found, as a rule, until two years after death, when small spots appear on the trunk. These spots spread until at four years after death all of the sapwood on the trunk is rotted. During the fifth year the bark usually falls from the trunk, and the rotted sapwood, which is full of insect burrows, dries out and starts to peel off. On Long Island the sapwood was off of all trees dead seven years. The heartwood was hard and sound, but all trees under 18 inches in diameter were so badly checked as to be unmerchantable. Checking starts in small trees in the second year, and in all trees is rapid from the fifth year on.

[1] The Bureau of Entomology is making a comprehensive study of insects affecting the chestnut and their relation to the bark disease.

MERCHANTABILITY.

Chestnut logs, poles, ties, and other products which are sound at the time of inspection should not be rejected because they come from trees infected with or killed by the bark disease. Nor are disease cankers or lesions on the wood sufficient reason for rejecting material. As already pointed out, the disease itself does not affect the soundness or strength of the timber, but merely kills the tree by girdling the bark. After the death of the tree, of course, checking and brittleness are likely to follow the drying out of the wood.

One of the largest pole-buying companies accepts poles cut from dead trees, provided there is no sap rot and the poles conform to specifications. A large railroad company accepts ties cut from dead chestnut, provided the wood is sound and does not show signs of decay or rot when inspected. Another large railroad has found that ties or poles cut from dead chestnut trees in which the sapwood has not rotted give satisfactory service.

On Long Island practically all of the dead chestnut found on the larger estates has been completely utilized, since the island offers excellent markets for chestnut dimension stuff, lumber, poles, and ties. In some cases the tops and limbs left after logging have been cut into kindling for the city markets. In southwestern Connecticut sound dead chestnut sells as well for most purposes as live timber. Millmen there usually saw trees that are 10 inches in diameter breasthigh and less into fence posts and small dimensions, trees from 10 to 18 inches diameter into ties and plank, and trees over 18 inches diameter into large dimension material with ties as a secondary product. It has been found that trees up to 10 inches diameter can be sawed into merchantable products after they have been dead four years, and trees from 10 to 18 inches diameter can be utilized profitably after they have been dead five years, while trees over 18 inches in diameter are merchantable six years after death. Slabs obtained in sawing dead logs are usually a complete loss because of sap rot and checking. Round fence posts may be cut from trees from 6 to 10 inches in diameter breasthigh and from the tops of the larger trees. They must not show sap rot to be accepted by railway or highway contractors. Sap-rotted posts should be considered satisfactory for farm use, however, since the sapwood is usually thin and the heartwood is almost invariably sound. The market for cordwood from dead trees is somewhat uncertain. Brass factories require wood cut from sound timber, with the bark tight and the sap hard and firm. Such wood comes from trees that have been dead less than a year. Limekilns can use wood in a poorer condition, and may accept wood from trees dead two or three years, provided it is sound. Brick companies prefer live wood, but in some cases may accept a small amount of dead material.

WHEN TO CUT DISEASED TREES.

Although disease-killed chestnut does not show deterioration until two years after death, infected trees should be cut and utilized as soon as possible after they are attacked. Diseased trees always die sooner or later unless treated; and actual death may not be noticed until too late in the spring to allow cutting before the next year. Dead timber is hard to chop and saw, and may break in felling. Trees often rot in the tops first, and poles cut from such trees may show decay in the top end. Moreover, diseased timber is still live timber and can be sold as such. Dead timber, even though sound, always presents difficulties in felling, manufacturing, and marketing.

Woodlot owners who can not cut their diseased chestnut before it dies should remove it within two years after death, before insect injury, decay, and checking have started. If poles are to be the product, however, the tree should be cut while yet alive, because of the likelihood of dead timber being broken in felling or while being loaded on cars. Poles cut from live trees are much more likely to be accepted by dealers and pole-using companies than poles cut from dead trees. However, poles cut from dead trees that are perfectly sound, especially in the sap, are as good as poles cut green and seasoned in piles. A pole seasoned on the stump is as good as one seasoned in a pile, and therefore the only reason for not cutting sound dead timber for poles is the probable breakage in felling and transportation due to the brittleness of the seasoned timber. Dead timber is satisfactory for round fence posts and hewed ties, if there is no sap rot. For sawed products (lumber, dimension stuff, sawed ties, switch timbers, sawed fence posts, shingles, and slack staves and heading) sapwood injury may be disregarded, as it will slab off. However, though heartwood is usually sound for six years or more after the death of the tree, it checks badly after the second year. Trees intended for sawed products in which checking is a defect should therefore be cut within two years after death. Timber which is too badly checked to be profitably manufactured into sawed products should be cut for cordwood.

Should woodlot owners wish to cut timber for which there is no immediate market, the following methods of storage are recommended:

Poles should be peeled and rolled upon skidways, at least 1½ feet high, built over bare ground, in situations exposed to sun and wind. There should be but one layer of poles upon each skidway. Ties should be hauled to a railroad right of way and piled according to the railroad's specifications. In no case should more than two ties in a pile come in contact with the ground, and the piles should be open enough to allow free circulation of air. The top layer of ties should form a slanting roof to shed water. Lumber and dimension stuff

FIG. 1.—Dead chestnut trees on Long Island. These trees should have been cut before the bark fell off and deterioration started.

should be piled under a shed with open sides to allow free circulation of air; piles in the open should have temporary roofs made of boards. The piles should be on skids, with several sticks between the layers of boards and dimensions. Cordwood should not be piled in the woods, but where it will be exposed to sun and wind. The piles should be built loosely and on well-drained ground. Two long sticks under each pile will prevent decay in the lower layers.

HOW TO MANUFACTURE AND MARKET CHESTNUT PRODUCTS.

Chestnut wood is light in weight, soft, not strong, coarse grained, stiff but brittle, nonelastic, easily seasoned but likely to check and warp, easily split, easy to work, and very durable in contact with the soil. It is suitable for poles, lumber, ties, slack cooperage, tannin-extract wood, mine timbers, shingles, fence posts and rails, piles, veneer, and fuel, but it can not profitably be used for tight cooperage, distillation, or excelsior. In deciding what product to manufacture from his stand the farmer should first consider his own needs for summer fuel, fence posts and rails, split shingles, barns and sheds, or even interior finish for a new house. Chestnut is well suited for barn frames, bridges, and general construction work because it is durable, and has practically the same strength as white pine, spruce, and hemlock. It will also serve for sheathing for barns and sheds. The wood has an attractive figure and takes finish well, which fits it for interior and cabinet work. It is hard enough for flooring, and is used to some extent for doors and for door and window frames. If the woodlot owner has more dead timber than he can use himself or dispose of to his neighbors he should consider making one or more of the following products to be sold to dealers, railroads, and manufacturing plants: Poles, saw logs, hewed ties, slack-cooperage bolts, tannin-extract cordwood, mine timbers, and cordwood for brickyards, limekilns, brass factories, iron foundries, etc. Any of these products can be made with the tools kept on every farm.

The manufacture of lumber on the ground requires a portable sawmill. Portable shingle and stave mills can also be obtained. Such an outfit would only be warranted if there was enough timber to insure several years' operation. Owners of portable mills, however, often buy timber when there is enough to warrant a set-up. Moreover, there may be a custom sawmill or one operated in connection with a lumber yard or woodworking plant in the neighborhood or in a near-by town. Such mills, besides doing custom work, often buy logs by the wagonload. Stave, heading, and shingle mills may often furnish a market for logs.

RELATIVE VALUE OF CHESTNUT PRODUCTS.

Table 1 will give the woodlot owner an idea of the value of his chestnut timber and the relative value of the various products. The values shown are average ones for manufactured material f. o. b. cars or delivered at the railroad right of way. To learn the value of his stumpage, the farmer must deduct the cost of cutting, sawing, and hauling from these values. Average values for chestnut products, other than poles, lumber, ties, and cordwood, are given later in the bulletin.

TABLE 1.—*Relative value of chestnut trees of different sizes cut into poles, lumber, ties, and cordwood.*

(Compiled from Tables 2, 3, 4, and 5.)

Size of tree.		Value of products.			
Diameter breast-high.	Height.	Poles (7-inch top), 25-foot, at $1.50; 30-foot, at $2.25; 35-foot, at $3.25; 40-foot, at $4.00; 45-foot, at $5.00; 50-foot, at $6.50; 55-foot, at $8.00; 60-foot, at $10.00;	Lumber at $20 per M or $0.02 per board foot.	8 feet by 6 inches by 8 inches sawed ties, at $0.50.	Cordwood, at $3.60 per cord or $0.04 per cubic foot.[1]
Inches.	*Feet.*				
4	50	.....	.....	.....	$0.08
5	50	.....	.....	.....	.13
6	50	.....	.....	.....	.18
6	60	.....	.....	.....	.22
7	50	.....	.....	.....	.25
7	60	.....	.....	.....	.29
8	50	.....	.....	.....	.32
8	60	.....	.....	.....	.38
8	70	.....	.....	.....	.44
9	50	.....	$0.20	.....	.40
9	60	.....	.30	.....	.47
9	70	.....	.44	.....	.54
10	50	.....	.52	$0.50	.50
10	60	.....	.64	.50	.58
10	70	.....	.80	.50	.66
10	80	.....	.96	.50	.71
10	90	.....	1.12	1.50	.76
11	50	.....	.84	.50	.61
11	60	.....	1.00	.50	.72
11	70	.....	1.16	1.00	.83
11	80	.....	1.38	1.00	.90
11	90	.....	1.60	2.00	.97
12	50	.....	1.16	1.00	.74
12	60	.....	1.36	1.00	.86
12	70	.....	1.56	1.50	1.00
12	80	.....	1.84	1.50	1.10
12	90	.....	2.14	2.00	1.20
13	50	$1.50	1.48	1.50	.87
13	60	1.50	1.74	1.50	1.01
13	70	1.50	2.00	1.50	1.16
13	80	1.50	2.32	2.00	1.28
13	90	1.50	2.66	2.50	1.41
14	50	2.25	1.84	1.50	1.00
14	60	2.25	2.14	1.50	1.17
14	70	2.25	2.44	2.50	1.35
14	80	2.25	2.82	2.50	1.51
14	90	2.25	3.20	4.00	1.65

[1] An average cord contains 90 stacked cubic feet.

TABLE 1.—*Relative value of chestnut trees of different sizes cut into poles, lumber, ties, and cordwood*—Continued.

Size of tree.		Value of products.			
Diameter breast-high.	Height.	Poles (7-inch top), 25-foot, at $1.50; 30-foot, at $2.25; 35-foot, at $3.25; 40-foot, at $4.00; 45-foot, at $5.00; 50-foot, at $6.50; 55-foot, at $8.00; 60-foot, at $10.00;	Lumber at $20 per M or $0.02 per board foot.	8 feet by 6 inches by 8 inches sawed ties, at $0.50.	Cordwood, at $3.60 per cord or $0.04 per cubic foot.[1]
Inches.	*Feet.*				
15	50	$3.25	$2.20	$2.50	$1.15
15	60	3.25	2.54	2.50	1.34
15	70	3.25	2.94	2.50	1.55
15	80	3.25	3.36	3.00	1.74
15	90	3.25	3.80	4.50	1.92
16	50	.....	2.58	3.00	1.30
16	60	.....	3.00	3.00	1.52
16	70	4.00	3.44	3.50	1.76
16	80	4.00	3.92	3.50	1.98
16	90	4.00	4.44	4.50	2.20
17	60	.....	3.48	3.00	1.71
17	70	4.00	4.00	4.00	1.98
17	80	5.00	4.52	4.00	2.24
17	90	5.00	5.10	5.00	2.52
18	60	.....	3.96	3.50	1.90
18	70	5.00	4.54	4.00	2.22
18	80	6.50	5.14	4.50	2.52
18	90	6.50	5.82	5.50	2.82
19	60	.....	4.46	3.50	2.06
19	70	.....	5.14	4.00	2.46
19	80	.....	5.84	5.00	2.80
19	90	8.00	6.56	6.00	3.16
20	60	.....	5.00	4.00	2.34
20	70	.....	5.76	5.00	2.74
20	80	.....	6.54	5.50	3.12
20	90	10.00	7.36	6.50	3.52
21	60	.....	5.52	4.50	2.60
21	70	.....	6.36	5.00	3.02
21	80	.....	7.26	5.50	3.44
21	90	.....	8.18	7.00	3.88
22	60	.....	6.10	5.50	2.84
22	70	.....	7.00	5.50	3.32
22	80	.....	8.00	7.00	3.80
22	90	.....	9.02	8.50	4.26
23	60	.....	6.66	6.00	3.12
23	70	.....	7.70	6.00	3.64
23	80	.....	8.80	7.00	4.16
23	90	.....	9.86	8.50	4.68
24	60	.....	7.26	6.00	3.42
24	70	.....	8.40	6.50	3.98
24	80	.....	9.58	7.50	4.56
24	90	.....	10.76	9.50	5.12
25	60	.....	7.92	7.50	3.72
25	70	.....	9.14	7.50	4.34
25	80	.....	10.40	9.00	4.96
25	90	.....	11.66	10.50	5.60

[1] An average cord contains 90 stacked cubic feet.

Cordwood values include whole trunk and top wood, with bark, up to a minimum diameter of 2 inches. Pole, lumber, and tie values do not include top wood, which, when a tree is cut into poles, lumber, or ties, will usually yield 20 cents, to 50 cents, worth of cordwood.

The values in Table 1 were compiled from volume tables computed from measurements of a large number of trees grown on medium quality chestnut soils. Volume tables express the average content,

and should not be applied to individual trees. Similarly, Table 1 expresses the average value of a large number of trees, and will not give the value of single trees. An example of the use of the table is as follows: Suppose a woodlot contains 100 chestnut trees of the same size, 14 inches diameter breasthigh, and 60 feet high, all straight and clear for at least 32 feet up. Tables 1 to 5 give the following products and their values for such a stand:

100 30-foot poles, worth $300 (plus the value of cordwood in top).
10,700 board feet of lumber, worth $214 (plus the value of cordwood in top).
300 ties, worth $150 (plus the value of cordwood in top).
32⅔ cords of wood, worth $117.

Assuming the costs of cutting and manufacturing to be:

Poles.	30 cents each.
Lumber	$7 a thousand board feet,
Hewn ties	12½ cents each,
Cordwood	$1 per cord,

and assuming, also, a team wage rate of $5 per day, a daily hauling capacity of two trips, and an average load as six 30-foot poles, 1,000 feet of lumber, 33 ties, or 1½ cords of wood, the cost of cutting, manufacturing, and hauling the different products would be as follows:

100 30-foot poles	$72, leaving a return of $153.
10,700 board feet of lumber	$102, leaving a return of $112.
300 ties	$60, leaving a return of $90.
32⅔ cords of wood	$87, leaving a return of $30.

If the timber owner does the cutting and hauling himself, the cost of production represents the labor of himself and team, and the return includes the value of the stumpage and a profit of about 20 per cent. A discussion of the principal chestnut products follows:

POLES.

About one-fifth of all the telegraph, telephone, and electric transmission poles used in the United States are chestnut. Pole logging is much the simplest and cheapest form of exploitation per unit of volume. It consists simply in felling the tree, sawing off the top at an inside bark diameter of 7 or 8 inches, trimming the branches close, and peeling. The cost of this is usually figured at 1 cent per foot in length for poles from 25 to 35 feet long, and 35 cents apiece for poles from 35 to 50 feet long. Pole cutting is most expensive in winter, when peeling is difficult. Contract logging rates are often 35 cents per pole in winter and 25 cents in summer. Some companies, however, accept only winter-cut poles, since the warm temperature and the greater amount of moisture in the outer layers of sapwood during summer favor attack by wood-rotting fungi.[1]

Chestnut poles may be marketed through the hundreds of pole dealers scattered throughout the region of the bark disease, or they

[1] From Forest Service Bul. 96, "Second-Growth Hardwoods in Connecticut."

may be sold to some one of the thousand telephone, electric light, and trolley companies in the same region, or to buyers for the large telegraph and telephone companies and the railroads. It is best whenever possible to get in touch with a local company.

Table 2 shows the dimensions of poles which may be obtained from trees of different sizes, and is followed by a set of chestnut-pole specifications, under which a large part of the telephone and telegraph poles are purchased. Many telephone, electric light, power, and traction companies, and railroads use their own specifications.

FIG. 2.—Chestnut poles, showing proportions and straightness required.

Telephone companies carrying only a few wires often accept small poles. A set of average prices paid by the Western Electric Co., f. o. b. cars, is also shown.

TABLE 2.—*Length of poles (7-inch top) obtainable from chestnut trees of different sizes.*[1]

Diameter breast-high.	Height of tree—feet.					Figures compiled from measurements of following number of trees.
	50	60	70	80	90	
	Length of poles.					
Inches.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Trees.*
13	25	25	25	25	25	11
14	30	30	30	30	30	17
15	35	35	35	35	35	6
16	.....	.....	40	40	40	14
17	.....	.....	40	45	45	6
18	.....	.....	45	50	50	11
19	.....	.....	.....	.....	55	6
20	.....	.....	.....	.....	60	4

[1] From Forest Service Bul. 96, "Second-Growth Hardwoods in Connecticut."

WESTERN ELECTRIC CO.

SPECIFICATIONS FOR CHESTNUT POLES.

All poles shall be of sound, live, white chestnut, squared at both ends, reasonably straight, well proportioned from butt to top, peeled, and knots trimmed to the surface of the pole.

The dimensions of the poles shall be according to the following table, the "top" measurement being the circumference at the top of the pole, the "butt" circumference being 6 feet from the butt.

Dimensions of poles.

Class "A."			Class "B."			Class "C."			Class "D."			Class "E."		
Length.	Top.	6 feet from butt.	Length.	Top.	6 feet from butt.	Length.	Top.	6 feet from butt.	Length.	Top.	6 feet from butt.	Length.	Top.	6 feet from butt.
Feet.	*Inches.*	*Inches.*	*Feet.*	*Inches.*	*Inches.*	*Feet.*	*Inches.*	*Inches.*	*Feet.*	*Inches.*	*Inches.*	*Feet.*	*Inches.*	*Inches.*
25	24	36	20	22	31	20	20	27	20	20	24	20	15½	23
30	24	40	25	22	33	25	20	30	25	20	27	25	15½	26
35	24	43	30	22	36	30	20	33	30	20	31	30	15½	29
40	24	45	35	22	40	35	20	36	35	20	35	35	20	34
45	24	48	40	22	43	40	20	40	40	20	39	40	20	38
50	24	51	45	22	47	45	20	43	45	20	43	45	20	42
55	22	54	50	22	50	50	20	46	50	20	46	50	20	46
60	22	57	55	22	53	55	20	49						
65	22	60	60	22	56									
70	22	63	65	22	59									
75	22	66	70	22	62									
			75	22	65									

Prices f. o. b. cars paid by the Western Electric Co. for poles of average size are as follows. Poles larger than the average bring better prices; poles smaller bring less:

20-foot poles	$0. 80–$1. 25	40-foot poles	$3. 25–$4. 00
25-foot poles	1. 00– 1. 50	45-foot poles	4. 25– 5. 00
30-foot poles	1. 65– 2. 25	50-foot poles	5. 00– 6. 50
35-foot poles	2. 25– 3. 25	55-foot poles	6. 00– 8. 00

The butt circumference of poles obtainable from standing trees may be ascertained by measuring the tree at a point as high above the average man's head as can be reached, to allow for the stump, and then deducting 4 or 5 inches for bark. Prices for long poles may seem to offer unusual profits for pole logging, but long high-

class poles must be very straight and well proportioned, and can be cut only from very big trees. Moreover, the market for such poles is limited; the bulk of purchases of chestnut poles by all companies in 1911 was divided according to length as follows:

Feet.	
Under 20	$24,517
20 to 29	298,710
30 to 39	289,702
40 to 49	66,421
50 and over	14,139
Total	693,489

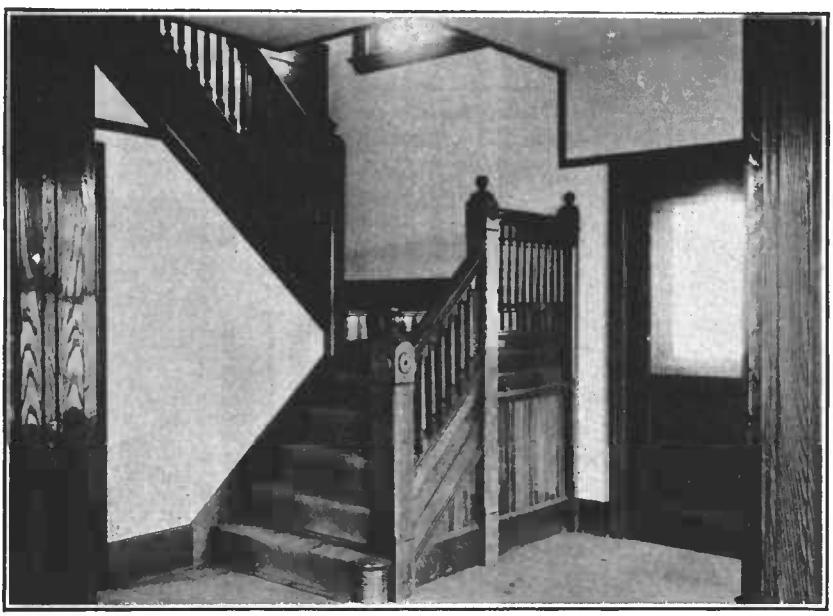

FIG. 3.—Stairway made from chestnut in house finished throughout in chestnut.

LUMBER.

A large amount of chestnut is manufactured into lumber, and finds place in interior finish, musical instruments, furniture, coffins, and other manufactured articles. Much of the chestnut used by woodworking plants in the Northern States comes from mills in Virginia, West Virginia, Kentucky, Tennessee, and North Carolina. The reason why these plants purchase southern chestnut rather than northern stock is because the southern mills always grade their lumber, making it possible for the manufacturer to obtain the class of material he needs. The southern mills also cut large quantities, so the supply of any one grade is fairly constant. Small mills in the

North might secure more of this trade if they could manufacture the equivalent of grades now used in certain lines. Summaries of chestnut grading rules follow.

HARDWOOD MANUFACTURERS' ASSOCIATION OF THE UNITED STATES.

Summary of grading rules for chestnut lumber.

	Firsts and seconds.	Firsts and seconds, wormy.
Lengths	8 feet and longer.	8 feet and longer.
Widths	6 inches and wider.	6 inches and wider.
Defects	Standard defects admitted in firsts: Up to 8 inches wide, none. 8 inches and over wide, one. Standard defects admitted in seconds: 6 to 7 inches wide, one. 8 to 10 inches wide, two. As the width increases defects increase in proportion.	Standard defects admitted in firsts: Up to 8 inches wide, none. 8 inches and over wide, one. Standard defects admitted in seconds: 6 to 7 inches wide, one. 8 to 10 inches wide, two. As the width increases defects increase in proportion. In addition to the above defects, wormholes admitted without limit.
	No. 1 common.	**No. 1 common, wormy.**
Lengths	6 feet and longer.	6 feet and longer.
Widths	4 inches and wider.	4 inches and wider.
Defects	Must work 66⅔ per cent or better, clear face cuttings, in cuttings which shall contain 144 square inches or more.	Must work 66⅔ per cent or better, clear face cuttings, in cuttings which shall contain 144 square inches or more. Wormholes admitted in the cuttings without limit.
		Sound wormy.
Lengths		6 feet and longer.
Widths		3 inches and wider.
Defects		Will admit wormholes without limit, but must work 66⅔ per cent or better sound cuttings.
		No. 2 common, wormy.
Lengths		6 feet and longer.
Widths		3 inches and wider.
Defects		Will admit wormholes without limit, but must work at least 50 per cent sound cuttings.
	No. 3 common.	
Lengths	4 feet and longer.	
Widths	3 inches and wider.	
Defects	Will include all lumber that does not come up to the grade of No. 2 common, wormy, that can be used for cheap boxing, crating, sheathing, etc.	

EXPLANATION.

Clear face cuttings.—A piece of lumber free from all defects on one side. The reverse side may contain small sound defects.

Sound cuttings.—A piece of lumber free from rot and other defects that would materially weaken the strength of the piece.

STANDARD DEFECTS.

Each one of the following items constitutes a standard defect, any of which may appear in the board up to the limit specified in the rule covering its quality:

One knot 1¼ inches in diameter.

Two knots so located that they will not exceed in damage one standard knot.

Wormholes, grub holes, or rafting pinholes not exceeding in damage one standard knot.

Heart, shake, rot, dote, or any defects not exceeding in damage one standard knot.

Bark or waney edge not to exceed 1 inch in the average, running not to exceed one-third the length of the board, only showing on one side and to be measured.

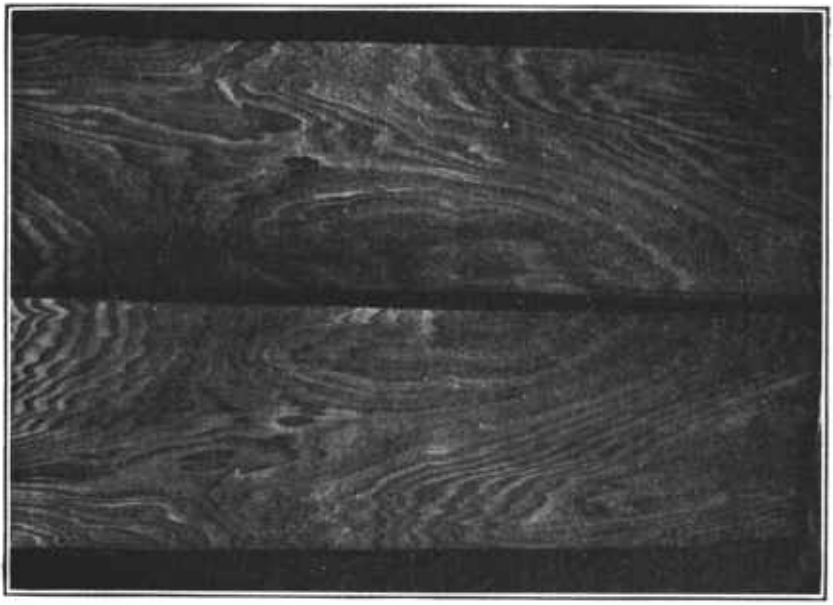

FIG. 4.—Chestnut veneer, showing the attractive grain.

NATIONAL HARDWOOD LUMBER ASSOCIATION.

Summary of chestnut grading rules.

Grade.	Length.	Width.	Defects allowed.
Firsts	8 feet and longer	6 inches and wider	Ranging from no defects in pieces containing 4 to 9 surface feet to two defects in pieces containing 16 surface feet.
Seconds	do	do	Ranging from 1 defect in pieces containing 5 surface feet to 5 defects in pieces containing 20 surface feet.
No. 1 common	4 feet and longer	4 inches and wider	Must work 66⅔ per cent or better clear face.
No. 2 common	do	3 inches and wider	Must work 50 per cent or better clear face.
No. 3 common	do	do	Must work 25 per cent or better sound cuttings.
Wormy	6 feet and longer	4 inches and wider	Wormholes admitted without limit, but otherwise must work 66⅔ per cent or better, sound cuttings.

"Clear face" means a cutting having the poor side clear.

A "sound cutting" is one free from rot, shakes, and other defects which materially impair the strength of the piece.

STANDARD DEFECTS.

One knot 1¼ inches in diameter.
Two knots not exceeding in extent or damage 1¼-inch knot.
Worm, grub, knot, or rafting pinholes not exceeding in damage one 1¼-inch knot.
Straight split in end longer than 6 inches.
Wane along one edge exceeding one-sixth the length of the board.

A representative scale of prices received by mills in Tennessee, Kentucky, and West Virginia for four representative grades of chestnut lumber is as follows:

Firsts and seconds, 4/4	$43 to $45
No. 1 common, 4/4	30 to 33
Sound wormy	15 to 18
No. 3 common	10 to 12

It is important to note that the prices received by southern mills for the upper grades are for almost clear lumber, long and wide. The minimum lengths and widths quoted in the summaries of grading rules are accepted only in a small proportion of the shipment. The usual run of logs yields but a small proportion of upper grades; much of the southern chestnut is wormy and below the grade of No. 1 common.

The chestnut lumber produced north of the Potomac River is largely used for local building and construction purposes. A great deal, of course, goes into sawed ties and in New England into switch timbers. The following partial list of uses for chestnut lumber in the Northern States shows the wide adaptability of the wood: Barn timbers, sheathing, floors and stalls, bridge plank, car construction, crating, docks, framing, floor lining and outside floors, ice houses, lath and tobacco lath, porches, pickets, roof boards, sheds, shingles, ship timbers, sidewalk stringers and plank, sills, and steps.

Following are the prices obtained for chestnut lumber cut in the Northern States in 1911, a representative year:

Average value of chestnut lumber per thousand f. o. b. mill, 1911.

State.	Value per thousand.	State.	Value per thousand.
Connecticut	$18.71	New Jersey	$17.50
Delaware	16.75	New York	17.44
Maryland	15.79	Pennsylvania	17.25
Massachusetts	18.28	Rhode Island	18.60
New Hampshire	17.99		

The cost of logging and sawing chestnut varies. For a portable mill operating in the woods the following costs are approximate:

	Per thousand.
Cutting	$1.25
Skidding	1.75
Sawing and piling	4.00
	7.00

To obtain the total cost of lumber, the value of stumpage, and the cost of hauling the lumber, loading it on cars, etc., must be added to the above.

Table 3 shows the amount of lumber which can be obtained from different-sized chestnut trees.

TABLE 3.—*Board feet of lumber obtainable from chestnut trees of different sizes.*[1]

[Based on measurements, from the various diameters, of from 2 to 17 trees.]

Diameter breasthigh.	Height of tree—feet.					Trunks of trees used to top diameter (inside bark).
	50	60	70	80	90	
Inches.	*Board feet.*	*Board feet.*	*Board feet.*	*Board feet.*	*Board feet.*	*Inches.*
9	10	15	22	.....	.....	7
10	26	32	40	48	56	7
11	42	50	58	69	80	8
12	58	68	78	92	107	8
13	74	87	100	116	133	8
14	92	107	122	141	160	8
15	110	127	147	168	190	9
16	129	150	172	196	222	9
17	.....	174	200	226	255	9
18	.....	198	227	257	291	10
19	.....	223	257	292	328	10
20	.....	250	288	327	368	10
21	.....	276	318	363	409	11
22	.....	305	350	400	451	11
23	.....	333	385	440	493	11
24	.....	363	420	479	538	12
25	.....	396	457	520	583	12

[1] From Forest Service Bul. 96, "Second-Growth Hardwoods in Connecticut."

Scaling by international rule, with 10 per cent deducted for circular saw kerf.

TIES.

Chestnut finds a wide use for ties, but it must meet the competition of better woods, and therefore does not hold its place as well as in the pole market. In durability it compares well with white oak, but its mechanical life in service is relatively short. Chestnut ties are both hewed and sawed, the cost of manufacture ranging from 10 cents per tie upward. Hewed ties may first be sawed to the proper lengths and then hewed flat on two parallel sides, or a tree may be hewed on two sides before cutting into tie lengths. Sawing costs more than hewing, but saves considerable lumber from the sides of logs. Moreover, sawed ties cost less to haul than hewed ones, and the cost of hauling is the most variable factor in the cost of tie production. As a rule, there is more profit in sawing lumber than ties. In the case of crooked trees, however, hewed ties are probably the most profitable product, provided there is not a sawmill or stave mill in the immediate vicinity. To secure information on the size of ties demanded and the prices paid, the stumpage owner should consult the nearest railroad station agent. Specifications used and prices paid by a few of the railroads during the winter of 1913–14 were as follows:

New York, New Haven & Hartford R. R.:	Size.	Price.
First class	8′ x 7″ x 7″—12″ hewed 8′ x 7″ x 9″ sawed	$0.70
Second class	8′ x 6″ x 6″—12″ hewed 8′ x 6″ x 8″ sawed	.55
Third class	8′ x 6″ x 5″—12″ hewed 8′ x 6″ x 7″ sawed	.35

	Size.	Price.
New York Central & Hudson River R. R.:		
First class	$8\frac{1}{2}'$ x 7″ x 7″—12″ pole $8\frac{1}{2}'$ x 7″ x 9″ square	$0.65
Second class	$8\frac{1}{2}'$ x 6″ x 9″ square	.60
Third class	$8\frac{1}{2}'$ x 6″ x 6″ pole $8\frac{1}{2}'$ x 6″ x 8″ square	.50
Pennsylvania Railroad:		
First class	$8\frac{1}{2}'$ x 7″ x 7″ pole x 8″ square	.55
Second class	$8\frac{1}{2}'$ x 7″ x 6″ pole x 7″ square	.45
Third class	$8\frac{1}{2}'$ x 6″ x 5″ pole x 6″ square	.20
Delaware, Lackawanna & Western R. R.:		
First class	$8\frac{1}{2}'$ x 7″ x 8″—12″ square $8\frac{1}{2}'$ x 7″ x 7″ pole	.60
Second class	$8\frac{1}{2}'$ x 6″ x 7″ square $8\frac{1}{2}'$ x 6″ x 6″ pole	.40

FIG. 5.—Making hewed chestnut ties.

Trolley ties usually range from 8 feet by 6 inches by 8 inches to 8 feet by 8 inches by 8 inches. Some companies accept a 7-foot tie and some take ties with faces as narrow as 5 inches.

Ties are usually required to be of sound timber, free from defects, and to have been cut in the fall, winter, or early spring. In New England chestnut is specified for switch timbers 7 by 9 inches, in lengths as ordered. They are purchased by the board foot, bringing from $18 to $20 per thousand feet.

Table 4 shows the number of ties obtainable from chestnut trees of different sizes.

TABLE 4.—*Number of 8-foot by 6-inch by 8-inch ties obtainable from chestnut trees of different sizes.*[1]

[Based on measurements, for the various diameters, of from 2 to 17 trees.]

Diameter breasthigh.	Height of trees—feet.				
	50	60	70	80	90
Inches.	*Number of ties.*	*Number of ties.*	*Number of ties.*	*Number of ties.*	*Number of ties.*
10	1	1	1	1	3
11	1	1	2	2	4
12	2	2	3	3	4
13	3	3	3	4	5
14	3	3	5	5	8
15	5	5	5	6	9
16	6	6	7	7	9
17	.....	6	8	8	10
18	.....	7	8	9	11
19	.....	7	8	10	12
20	.....	8	10	11	13
21	.....	9	10	11	14
22	.....	11	10	14	17
23	.....	12	12	14	17
24	.....	12	13	15	19
25	.....	15	15	18	21

[1] From Forest Service Bul. 96, "Second-Growth Hardwoods in Connecticut."

FIG. 6.—Chestnut poles to be used for the manufacture of keg staves.

SLACK COOPERAGE.

Chestnut is being used for nail-keg staves. These are $\frac{3}{8}$-inch thick, 18 inches long, and from 2 to 5 inches at the bilge. They are usually required to be chamfered, crozed, and jointed. Chestnut is also used for cement, apple, and other kinds of slack barrel staves. Barrel staves are 28 or 28$\frac{1}{2}$ inches long, and from 2 to 6 inches wide; cement staves are $\frac{3}{8}$ to $\frac{1}{2}$ inch thick; apple staves $\frac{1}{3}$-inch thick, and flour staves, $\frac{2}{5}$-inch

thick. Barrel staves are neither chamfered nor crozed at the mill. Chestnut is also used for slack heading. The manufacture of staves is one of the best means of utilizing wood, since material as small as 3 inches in diameter and 19 inches long will often be accepted. Slack cooperage mills sometimes purchase logs and bolts which may be measured by the cord. Some of the bolts may be as small as 3 or 4 inches in diameter, but the greater portion must be from 6 to 10 inches. Bolts for keg staves are about 19 inches long, and those for barrel staves from 28½ to 30 inches long. Stave bolts, on account of their small size, offer an excellent opportunity for the utilization of trees too crooked, defective, or small for poles, lumber, and ties. Cooperage mills pay up to $4.50 and $5 for chestnut cordwood delivered. The average selling price at mill of chestnut barrel staves is from $5 to $6 per thousand.

FIG. 7.—Interior of stave mill, showing, from left to right, circular saw, stave saw, stave equalizer, and stave jointer.

Representative specifications for sawed keg and cement barrel staves are given below. Other kinds of barrel staves and heading are governed by the rules of the National Slack Cooperage Manufacturers' Association.

Specifications for sawed keg staves.

All staves shall be bilge sawed, 18 inches long after trimming, and to be free from bark, large knots, loose knots, knot holes, and wormholes. By large knots is meant knots large enough to weaken staves. Staves shall be of such uniform thickness that when put together and closely clamped the combined thickness of six staves shall be 2¼ inches when dry, and under no circumstances shall they be less than this measurement. Both ends are to be properly chamfered and crozed. All staves to be of usual widths, ranging from 2 to 5 inches, without any large proportion of exceedingly wide or extremely narrow staves. They are to be carefully jointed, to be of the same width at both ends, and to have ⅜-inch bilge, which is the difference in measurement between the width of staves measured on bilge line and measured at end of stave; all measurements to be made on the outside of stave. All staves to be thoroughly seasoned before shipment.

Specifications for sawed cement barrel staves.

Staves to be 28½ inches long, sawed ½ inch thick, and to be of uniform thickness. Joints to be exact ⅝-inch bilge, with 9-inch quarter. By 9-inch quarter we mean that if two staves be held together on the joints, end to end, they shall close tight 9 inches from end toward center. Staves must be of equal widths at each end. The joints must be smooth, no slivered nor broken joints to be included. No staves to be wider than 5½ inches nor narrower than 2½ inches across the bilge. There must be a bevel or undercut on the joint, suitable to work on a 16-inch head. There must be no bark on any part of the stave. Joints must be full and flush. There must be no holes, black knots, nor large breakable knots. Black knots will drop out, leaving holes. Staves with checks or splits must not be included. These should be rejointed at mill; if shipped, will be culled. Staves must be made from sound live timber only. Staves made from old brash or doty timber will not answer. Staves to be put up in bundles of not over 52 nor under 50 staves per bundle of 200 inches. All staves must be thoroughly air-dried before bundled.

FIG. 8.—16-inch chestnut bolts slabbed for shingle saw.

SHINGLES.

Chestnut shingles are manufactured and used locally in practically all the States where the bark disease exists. They do not compete in the general market with cedar shingles and should be manufactured only when they can be sold in the community or through a local lumber yard. Most chestnut shingles are sawed, although they may be split. The farmer who needs shingles and has dead chestnut in his woodlot should split enough for the purpose. This can be done by cutting blocks the length of a shingle, splitting them with a frow and shaving the shingle on both sides with a drawknife to secure the proper taper. Chestnut shingles are likely to warp, but this may

be overcome either by making the shingles in lengths of 16 inches, rather than longer, or else edge-grain shingles, which are said to warp but little. Leaking around the nails is likely to occur because the tannin in the wood corrodes iron, but it can be avoided by using galvanized nails. With these two disadvantages overcome, chestnut makes a durable shingle, having been known to last for 35 years. Chestnut shingles are from 16 to 24 inches long, and bring from $2.50 up per thousand. Since they are cut from short blocks, they may be made from trees too crooked and defective for poles, lumber, or ties.

FENCE POSTS AND RAILS.

Chestnut is used for fence posts and rails, for which it is one of the most durable woods. The cost of a wire fence and a rail fence of mortised posts and split rails is about the same. For this reason the woodlot owner who has dead chestnut should consider whether it would be advisable to build a wire fence when he has material which if cut now would answer the purpose.

Specifications for fence posts used by two railroads follow:

Fence posts must be round, sound, free from shakes, rotten knots, and bark; must be 7½ feet long and 6 inches in diameter at tip. Price 12 cents each. Rejected ties conforming to these specifications and 7½ to 8½ feet long are accepted as fence posts.

Fence posts to be 8 feet long, not less than 5 inches in diameter at small end, straight, sound, and sawed off at ends; price 10 cents each.

TANNIN EXTRACT.

Chestnut wood is used more than any other by tannin-extract plants. Northern timber contains less tannin, however, than southern timber, though there is no evidence that the bark disease decreases the tannin content. In the South old timber has a tannin content of 12 per cent, and second growth of 7 per cent; while in the North the tannin content of the former is 7 per cent and of the latter only 3 or 4 per cent. For this reason there are few tannin-extract plants north of the Potomac River, so that this market for chestnut timber in the region of the bark disease is very limited. Several tannin-extract plants, however, are in Pennsylvania, and sample specifications are given below, for the information of chestnut owners in that State:

Wood must be cut 4 feet in length if sawed, and when chopped it must measure 4 feet in length counting only half the slope on each end, and not counting 4 feet from point to point. The wood must be left as coarse as it can be conveniently handled but no large sticks or knots over 12 inches in diameter should be shipped, and when the whole tree is cut for extract wood we will receive it down to, but in no case less than, 4 inches at the small end. All knots must be closely trimmed; all cars must be loaded to their full capacity; slab wood will not be received at any price; not over 10 per cent of small wood, say 4 inches, will be received in any one car.

Prices f. o. b. cars in Pennsylvania range from about $2.50 to $3 for a standard cord of 128 cubic feet, and from $3 to $3.50 for a

long cord of 160 cubic feet. It costs about $1 a cord to cut the wood, while the cost of hauling necessarily depends on the distance. Table 5 shows the number of cubic feet of cordwood obtainable from trees of different sizes.

TABLE 5.—*Amount of cordwood obtainable from chestnut trees of different sizes.*[1]

[Based on measurements, for the various diameters, of from 2 to 18 trees.]

Diameter breast high.	Height of tree—feet.					
	40	50	60	70	80	90
Inches.	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*
4	1.6	2.1	.....	.....	.....	.....
5	2.6	3.3	.....	.....	.....	.....
6	3.7	4.6	5.6	.....	.....	.....
7	5.0	6.2	7.3	.....	.....	.....
8	6.5	7.9	9.4	11.0	.....	.....
9	8.4	10.1	11.8	13.6	.....	.....
10	10.5	12.5	14.5	16.6	17.8	19.0
11	12.8	15.3	17.9	20.7	22.5	24.3
12	15.4	18.4	21.5	25.0	27.4	30.0
13	18.2	21.7	25.2	29.1	32.1	35.3
14	.....	25.0	29.2	33.8	37.7	41.3
15	.....	28.8	33.6	38.8	43.4	48.0
16	.....	32.6	38.1	44.0	49.5	55.0
17	.....	36.5	42.7	49.5	56.0	63.0
18	.....	40.5	47.4	55.5	63.0	70.5
19	.....	44.3	51.4	61.5	70.0	79.0
20	.....	49.0	58.5	68.5	78.0	88.0
21	.....	.....	65.0	75.5	86.0	97.0
22	.....	.....	71.0	83.0	95.0	106.5
23	.....	.....	78.0	91.0	104.0	117.0
24	.....	.....	85.5	99.5	114.0	128.0
25	.....	.....	93.0	108.5	124.0	140.0

[1] From Forest Service Bul. 96, "Second-Growth Hardwoods in Connecticut."

The approximate number of cords in a stand of trees may be obtained by dividing the total cubic content by 90.

Volumes include stem and top wood, with bark, up to a minimum diameter of 2 inches. Average stump heights vary from 6 inches for small trees to 21 inches for large ones.

MINE TIMBERS.

Chestnut is used for mine timbers, but can be profitably cut for this purpose only if it is within hauling distance of a mine or of a railroad giving a low freight rate on this commodity. In the form of round dimension or sawed pieces chestnut is used for practically every class of material demanded by mines. Mine props are usually round and in lengths from about 2½ feet up. Usually, however, they are purchased in lengths of from 10 to 30 feet, and of a diameter at the small end of from 2 to 8 inches. Collar timbers are larger than props and are sometimes sawed instead of round. They range from 10 to 30 feet in length and from 10 to 14 inches in diameter. Representative prices paid for props and collar timbers delivered at mines, cars, or wharves are as follows:

Diameter inside bark at small end.	Price per linear foot.	Diameter inside bark at small end.	Price per linear foot.
4 inches	$0.01	9 inches	$0.05
6 inches	.02	10 inches	.06
7 inches	.03	12 inches	.10
8 inches	.04	14 inches	.14

Mine timbers are also purchased by [illegible], at prices from $2.85 to $4.25. Flat mine ties range from [illegible] feet long by 2½ inches thick by 3½ inches face, purchased at 4½ c[illegible] to 6 feet long by 6 inches thick by 6 inches face, at 1[illegible] The average size is probably about 5 feet long by 5 inch[illegible] by 5 inches face, and the average price is about 9 cents. I[illegible]ched mine ties made of chestnut are seldom accepted. P[illegible] for lagging are from 5 to 7 feet long, with a diameter at [illegible] end of from 2 to 2½ inches. Sprags are from 18 to 22 incl[illegible] th a middle diameter of 2½ to 3½ inches, and taper to a poi[illegible] ends. Woods harder than chestnut are usually preferred. [illegible] so purchase chestnut in lumber and dimension sizes.

MISCELLANEOUS [illegible].

In some sections of the East, bric[illegible], [illegible] kilns, and brass factories use large quantities of wood fo[illegible]. [illegible]st of these companies will accept cordwood that contains [illegible] chestnut, paying for the mixed wood from $3.50 to $4.50 [illegible]. Stumpage owners in the vicinity of such plants should as[illegible] with the idea of converting their dead timber into cord[illegible]led there is no better market for it. It is better, of cou[illegible] a little on the dead timber now than to lose everythi[illegible]g several years. As a household fuel chestnut is not as [illegible]ory or white oak, and will throw sparks from an open fire[illegible]ers of small amounts of dead chestnut, however, can u[illegible]erial for summer fuel and, at the same time, improve t[illegible]ts. Chestnut can be manufactured into charcoal, but [illegible]n would have to be conducted with extreme skill, and t[illegible] would have to compete with charcoal made by wood distil[illegible]. These latter do not use chestnut, since the proportion [illegible] obtained from it is too low. Charcoal burning in pits wi[illegible] as the material, however, is being carried on in a few p[illegible]rofit, but this means of utilizing the timber should be co[illegible]y if no other means is open.

If there is a veneer plant witl[illegible] distance and disease-infected timber can be cut the[illegible]n the trees are killed, before commencing to dry out, t[illegible] be a market for large, sound logs. In grape-raising d[illegible] chestnut can be used for vineyard props. Along the coa[illegible]en used for piles, ship timbers, and posts for foundatio[illegible]s. Chestnut poles 8 to 12 feet long and from 4 inches up[illegible] hewed on one side, have been reported as sold for cribbi[illegible] a construction.

RECOMMENDATIONS.

1. Diseased chestnut should be cut, if possible, during the first winter after infection.[1] The utilization of timber killed by the bark disease does not depend upon the development of markets, but on getting the timber on the present market before it deteriorates and becomes unmerchantable.

2. The owner should carefully consider the various products marketable in the locality which he can obtain from his chestnut trees, and should select the one most profitable.

3. It is best for the owner to do the cutting, manufacturing, and hauling himself in order to save operators' profits. In the case of large tracts of timber, however, an experienced operator should be hired.

4. The owner of dead chestnut, who wishes to learn of markets for products which he can manufacture himself or of an operator who can handle his woodlot, should write to the forestry official in his State. These officials are:

State Forester	Concord, N. H.
State Forester	Boston, Mass.
Commissioner of Forestry	Chepachet, R. I.
State Forester	New Haven, Conn.
Conservation Commission	Albany, N. Y.
State Forester	Trenton, N. J.
Commissioner of Forestry	Harrisburg, Pa.
Secretary Board of Agriculture	Dover, Del.
State Forester	Baltimore, Md.
Commissioner of Agriculture	Richmond, Va.
Forester, State Crop Pest Commission	Martinsburg, W. Va.

These State officers can furnish the following lists:

Sawmill operators experienced in cutting chestnut lumber and sawed ties.
Telephone, electric light, power, and traction companies which buy chestnut poles.
Steam and electric railroads which buy chestnut ties.
Pole and tie operators and dealers.
Slack cooperage mills, tannin extract plants, etc.

5. Any owner of chestnut stumpage who wishes more detailed information on utilization or woodlot management than is given in this bulletin should apply to the Forest Service, Washington, D. C.

[1] The following suggestions are made for woodlot management: If less than 50 per cent of the original stand is chestnut its removal will amount to only a thinning, thus increasing the growing space of the remaining trees. Nothing further would ordinarily be required to insure continued timber production over the entire area. When chestnut predominates in the stand it may be best to cut the area clean and plant with white or Norway pine or red oak.

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